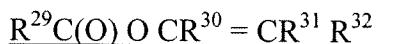


CLAIMS

The following claim listing will replace all prior versions, and listings, of claims in this application:

1. (Canceled).
2. (Currently amended) A process according to claim 4 30, wherein the ratio of branched:linear product from carbonylation process is greater than 1.5:1.
3. (Currently amended) A process for the carbonylation of vinyl acetate comprising reacting a vinyl acetate compound of formula (IV)

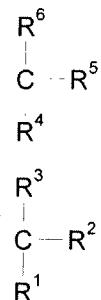
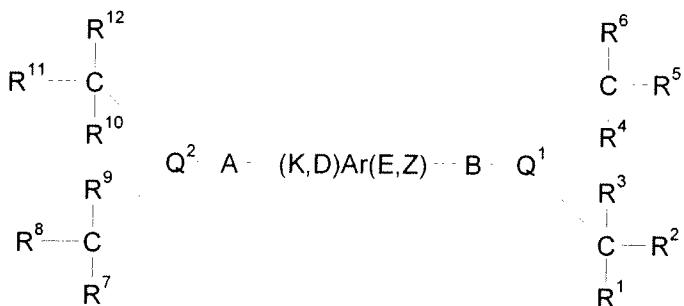
(IV)



wherein R²⁹ may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷, and C(O)SR²⁹
wherein R¹²-R¹⁸ and R¹⁹-R²⁷ are as defined below and R³⁰-R³² independently represent
hydrogen, lower alkyl, aryl or Het as defined herein, with carbon monoxide in the presence of a
source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

- (a) a metal of Group VIII B or a compound thereof; and
- (b) a bidentate phosphine, arsine or stibine of formula (I)

(I)



wherein:

Ar is a bridging group comprising an optionally substituted aryl moiety to which the ~~phosphorus~~ Q¹ and Q² atoms are linked on available adjacent carbon atoms;

A and B each independently represent lower alkylene;

K, D, E and Z are substituents of the aryl moiety (Ar) and each independently represent hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷, C(O)SR²⁷, or -J-Q³(CR¹³(R¹⁴)(R¹⁵))CR¹⁶(R¹⁷)(R¹⁸) where J represents lower alkylene; or two adjacent groups selected from K, Z, D and E together with the carbon atoms of the aryl ring to which they are attached form a further phenyl ring, which is optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)R²⁵R²⁶, SR²⁷ ~~or and~~ C(O)SR²⁷ or, when Ar is a cyclopentadienyl group, Z may be represented by -M(L₁)_n(L₂)_m and Z is connected via a metal ligand bond to the cyclopentadienyl group;

R¹ to R¹⁸ each independently represent lower alkyl, aryl, or Het;

R¹⁹ to R²⁷ each independently represent hydrogen, lower alkyl, aryl, or Het;

M represents a Group VIB or VIIIB metal or metal cation thereof;

L₁ represents a cyclopentadienyl, indenyl or aryl group each of which groups are optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷, C(O)SR²⁷ ~~or and~~ ferrocenyl;

L₂ represents one or more ligands each of which are independently selected from hydrogen, lower alkyl, alkylaryl, halo, CO, PR⁴³R⁴⁴R⁴⁵ ~~or and~~ NR⁴⁶R⁴⁷R⁴⁸;

R⁴³ to R⁴⁸ each independently represent hydrogen, lower alkyl, aryl, or Het;

n = 0 or 1;

and m = 0 to 5;

provided that when n = 1 then m equals 0, and when n equals 0 then m does not equal 0;

Q¹, Q² and Q³ (~~when present~~) each independently represent phosphorous phosphorus, arsenic or antimony ~~and in the latter two cases references to phosphine or phosphorous above are amended accordingly.~~

4. (Canceled).

5. (Currently amended) A process according to claim + 30, wherein the Group VIII B metal is palladium.

6. (Currently amended) A process according to claim + 30, wherein the linear (n) and branched (iso) products of the carbonylation may be separated either before or after the treatment step of chemically treating the product.

7. (Currently amended) A process according to claim + 30, wherein the products of the reaction are separated by distillation.

8. (Currently amended) A process according to claim + 30, wherein when K, D, E or Z represent -J-Q³(CR¹³(R¹⁴)(R¹⁵))CR¹⁶(R¹⁷)(R¹⁸), the respective K, D, E or Z is on the aryl carbon adjacent the aryl carbon to which A or B is connected or, if not so adjacent, is adjacent a remaining K, D, E or Z group which itself represents -J-Q³(CR¹³(R¹⁴)(R¹⁵))CR¹⁶(R¹⁷)(R¹⁸).

9. (Canceled)

10. (Currently amended) A process according to claim ~~4~~ 30, wherein the carbon monoxide may be used in pure form or diluted with an inert gas ~~such as nitrogen, carbon dioxide or a noble gas such as argon.~~
11. (Currently amended) A process according to claim ~~4~~ 30, wherein the ratio (volume/volume) of vinyl acetate compound to hydroxyl group-containing compound lies in the range of 1:0.1 to 1:10.
12. (Currently amended) A process according to claim ~~4~~ 30, wherein the amount of Group VIII B metal is in the range 10^{-7} to 10^{-1} moles per mole of vinyl acetate compound.
13. (Currently amended) A process according to claim ~~4~~ 30, wherein the carbonylation of a vinyl acetate compound is performed in one or more aprotic solvents.
14. (Original) A process according to claim 13, wherein the aprotic solvent has a dielectric constant that is below 50 at 298.15 K and at $1 \times 10^5 \text{ Nm}^{-2}$.
15. (Currently amended) A process according to claim ~~4~~ 30, wherein the catalyst compounds act as a heterogeneous catalyst.
16. (Currently amended) A process according to claim ~~4~~ 30, wherein the catalyst compounds act as a homogeneous catalyst.
17. (Original) A process according to claim 15 wherein the process is carried out with the catalyst comprising a support.
18. (Original) A process according to claim 17, wherein the support is insoluble.
19. (Currently amended) A process according to claim 17, wherein the support comprises a polymer, ~~such as a polyolefin, polystyrene or polystyrene copolymer such as a divinylbenzene copolymer or other suitable polymers or copolymers known to those skilled in the art;~~ a silicon

~~compound, derivative such as a functionalised silica, a silicone or a silicone rubber; or other porous particulate material such as for example inorganic oxides and inorganic chlorides.~~

20. (Currently amended) A process according to claim + 30, wherein the carbonylation is carried out at a temperature of between –10 and 150°C.

21. (Currently amended) A process according to claim + 30, wherein the carbonylation is carried out at a CO partial pressure of between $0.80 \times 10^5 \text{ N.m}^{-2}$ – $90 \times 10^5 \text{ N.m}^{-2}$.

22. (Currently amended) A process according to claim + 30, wherein the carbonylation is carried out at a low CO partial pressure of between 0.1 to $5 \times 10^5 \text{ N.m}^{-2}$.

23. (Currently amended) A process according to claim + 30, wherein the bidentate phosphine is independently selected from any of the following: bis (di-t-butyl phosphino)-o-xylene (also known as 1,2 bis (di-t-butylphosphinomethyl) benzene); 1,2 bis (diadamantylphosphinomethyl) benzene; 1,2 bis (diadamantylphosphinomethyl) naphthalene; 1,2 bis (di-t-pentyl phosphino)-o-xylene (also known as 1,2 bis (di-t-pentyl-phosphinomethyl) benzene); bis 2,3 (di-t-butyl phosphinomethyl) naphthalene; 1,2-bis-(ditertbutylphosphinomethyl) ferrocene; 1,2,3-tris-(ditertbutylphosphinomethyl) ferrocene; 1,2 bis (diadamantylphosphinomethyl) ferrocene; and 1,2 bis (di-t-pentyl phosphinomethyl) ferrocene.

24. (Canceled)

25. (Canceled)

26. (Canceled)

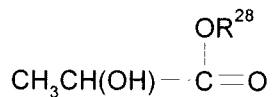
27. (Currently amended) ~~The use of a catalyst~~ A process according to claim + 30, wherein ~~the treatment is chemically treating comprises~~ hydrolysis or transesterification.

28. (Currently amended) ~~The use of the catalyst A process according to claim 27, wherein chemically treating comprises hydrolysis and the product is hydrogenated subsequent to hydrolysis.~~

29. (New) A process according to claim 3 for producing mainly branched product.

30. (New) A process for the production of a lactate ester or acid of formula II

(II)



wherein R²⁸ is selected from H and a C₁-C₃₀ alkyl or aryl moiety which may be substituted or unsubstituted and either branched or linear,

comprising the steps of carbonylating a vinyl acetate compound of formula (IV)

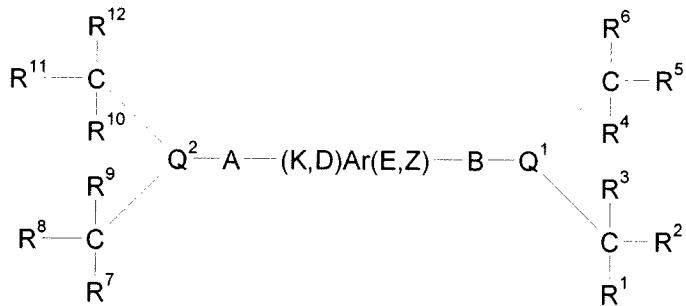
(IV)



wherein R²⁹ may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, SR²⁷, and C(O)SR²⁹ wherein R¹²-R¹⁸ and R¹⁹-R²⁷ are as defined below, and R³⁰-R³² represent hydrogen, with carbon monoxide in the presence of a source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

- (a) a metal of Group VIII B or a compound thereof; and
- (b) a bidentate phosphine, arsine or stibine of formula (I)

(I)



wherein:

Ar is a bridging group comprising an optionally substituted aryl moiety to which the Q¹ and Q² atoms are linked on available adjacent carbon atoms;

A and B each independently represent lower alkylene;

K, D, E and Z are substituents of the aryl moiety (Ar) and each independently represent hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷, C(O)SR²⁷, or -J-Q³(CR¹³(R¹⁴)(R¹⁵))CR¹⁶(R¹⁷)(R¹⁸) where J represents lower alkylene; or two adjacent groups selected from K, Z, D and E together with the carbon atoms of the aryl ring to which they are attached form a further phenyl ring, which is optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷ and C(O)SR²⁷ or, when Ar is a cyclopentadienyl group, Z may be represented by -M(L₁)_n(L₂)_m and Z is connected via a metal ligand bond to the cyclopentadienyl group;

R¹ to R¹⁸ each independently represent lower alkyl, aryl, or Het;

R¹⁹ to R²⁷ each independently represent hydrogen, lower alkyl, aryl, or Het;

M represents a Group VIB or VIIIB metal or metal cation thereof;

L₁ represents a cyclopentadienyl, indenyl or aryl group each of which groups are optionally substituted by one or more substituents selected from hydrogen, lower alkyl, halo, cyano, nitro, OR¹⁹, OC(O)R²⁰, C(O)R²¹, C(O)OR²², NR²³R²⁴, C(O)NR²⁵R²⁶, C(S)NR²⁵R²⁶, SR²⁷, C(O)SR²⁷ and ferrocenyl;

L₂ represents one or more ligands each of which are independently selected from hydrogen, lower alkyl, alkylaryl, halo, CO, PR⁴³R⁴⁴R⁴⁵ and NR⁴⁶R⁴⁷R⁴⁸;

R⁴³ to R⁴⁸ each independently represent hydrogen, lower alkyl, aryl, Het;

n = 0 or 1;

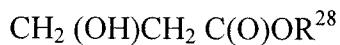
and m = 0 to 5;

provided that when n = 1 then m equals 0, and when n equals 0 then m does not equal 0; and

Q¹, Q² and Q³ each independently represent phosphorous, arsenic or antimony; to produce a product comprising a branched (iso) product and chemically treating said branched (iso) product to produce the corresponding lactate or acid of formula II.

31. (New) A process for the production of a 3-hydroxy propanoate ester or acid of formula (III)

(III)



wherein R²⁸ is selected from H, and a C₁-C₃₀ alkyl or aryl moiety which may be substituted or unsubstituted and either branched or linear,

comprising the steps of:

carbonylating a vinyl acetate compound of formula (IV)

(IV)



wherein R^{29} may be selected from hydrogen, lower alkyl, aryl, Het, halo, cyano, nitro, OR^{19} , $OC(O)R^{20}$, $C(O)R^{21}$, $C(O)OR^{22}$, $NR^{23}R^{24}$, $C(O)NR^{25}R^{26}$, $C(S)NR^{25}R^{26}$, SR^{27} and $C(O)SR^{29}$ wherein

R^{12} – R^{18} each independently represent lower alkyl, aryl, or Het;

R^{19} to R^{27} each independently represent hydrogen, lower alkyl, aryl, or Het;

and R^{30} – R^{32} represent hydrogen, with carbon monoxide in the presence of a source of hydroxyl groups and of a catalyst system, the catalyst system obtainable by combining:

- (a) a metal of Group VIII B or a compound thereof; and
- (b) a bidentate phosphine, arsine or stibine of formula (I) in accordance with claim 30

to produce a product comprising a linear (n) product and chemically treating said linear (n) product to produce the 3-hydroxy propanoate ester or acid of formula (III).